

## Structure Functions and Tau Neutrino Cross-Section at DUNE Far Detector

*Tuesday, 2 August 2022 15:42 (22 minutes)*

The high statistics and excellent resolution capabilities of DUNE's  $^{40}\text{Ar}$  detector will allow us to make precise studies about phenomena that have, until now, seemed too complex to measure, like tau neutrinos ( $\nu_\tau$ ) detection and therefore, provide a completion of the 3-flavor neutrino paradigm. Quasi-elastic scattering (QE),  $\Delta$  resonance production (RES), and deep inelastic scattering (DIS) processes are known to give dominant contributions in the medium and high neutrino energy to the total cross-section of  $\nu_\tau(\text{N})$  and  $\bar{\nu}_\tau(\text{N})$  cross-sections. These cross-sections have large systematic uncertainties compared to the ones for  $\nu_\mu$  and  $\nu_e$ . Studies point out that the reason for these difference is due to the model dependence of the  $\nu_\tau(\text{N})$  cross-sections in treating the nuclear medium effects described by the nucleon structure functions,  $F_{1N,\dots,3N}(x, Q^2)$  for  $\nu_\mu$  and  $\nu_e$ . These nucleon structure functions are used to calculate DIS cross-section by including kinematical corrections, but due to the addition of the  $\tau$ -lepton mass another two additional nucleon structure functions become non-negligible,  $F_{4N}(x, Q^2)$  and  $F_{5N}(x, Q^2)$ . There is a special interest in the DIS processes originated by charged leptons and (anti)neutrinos on nucleons and nuclear targets as they play an instrumental role in the quark-parton structure of the free nucleons and nucleons when they are bound in a nucleus. This talk will show the semi-theoretical and experimental approach to the estimation of the  $\nu_\tau(\text{N})$  and  $\bar{\nu}_\tau(\text{N})$  cross-sections in DUNE for the DIS region. We aim to look over changes in  $Q^2$ , and the contributions of the additional nucleon structure functions  $F_{4N}(x, Q^2)$  and  $F_{5N}(x, Q^2)$ .

### Attendance type

In-person presentation

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